



MALCOLM
Look to the Blue

November 27, 2017

Rune Storesund
Storesund Consulting
154 Lawson Road
Kensington, CA 94707

Re: California WaterFix / BDCP Alternative 4A Intake Structure Foundation Piles

Dear Mr. Storesund:

At your request, we have reviewed the Animation Video of Intake Construction Sequence https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/petitioners_exhibit/dwr/dwr_2a.mp4 and The Conceptual Engineering Report dated March 10, 2010.

We understand that the community is concerned about the noise that will be generated during construction by driving thousands 42-inch diameter steel piles to support these intake structures.

To address community concerns about noise and to achieve an efficient, highly productive, and vibration free installation we would recommend the use of CFA piles rather than driven piles. CFA piles are also commonly called Augercast, Augered Cast in Place Piles (ACIP) or Auger Pressure Grouted Piles (APG). They are predominantly used in unstable soil conditions with a high ground water level when conventional drilling would require casing or drilling to stabilize the bore hole. CFA piles can be installed very efficiently with modern high-torque hydraulic drilling rigs up to a depth of 115 feet and 48 inches in diameter. Crane mounted lead systems extend the installation range beyond 170 feet, however, pile diameters are reduced with depth.

CFA installations are highly productive and vibration free. Pile capacities of up to 1,500 tons can be achieved depending on the soil strata. The high productivity of this technology makes CFA piles most suitable for larger projects. Our Deep Foundation Brochure, which includes more information about CFA piles and other vibration free pile systems is attached.

Malcolm Drilling Company, Inc.
3503 Breakwater Court, Hayward, CA 94545
Tel. 510-780-9181 Fax 510-780-9167
Contractors License No. 259543

A reasonable budge price for CFA piles for the California WaterFix intake foundations would be \$250 per lineal foot for 42 inch by 100 foot piles. This includes drilling, 1% rebar, and concrete. I am confident that a cost-effective, non-impact system of pile installation can be achieved for the California WaterFix intake foundations. Malcolm Drilling would be interested in performing the pile installation for this project.

Malcolm Drilling Company has been expert in specialty foundation installations since 1962. Our customers value Malcolm's expertise in developing and implementing innovative and cost effective design build solutions for their projects. The synergy of over 50 years of engineering and our state of the practice equipment enables us to offer our customers the full spectrum of design build efficiency. Malcolm has successfully provided design build services in deep foundation solutions, including drilled shafts in sizes up to 15 feet in diameter and depth up to 350 feet, drilled shafts with rock sockets, in-water deep foundations, and many other applications.

For 8 consecutive years, Malcolm has received the ADSC-IAFD Safety Award. These Safety Awards are presented annually to recognize outstanding achievement in combined field and shop safety efforts of ADSC Contractors. Malcolm has worked hard to obtain the excellent safety program and record we have today. We are committed to constantly working harder to make it even better. Malcolm Company has a zero tolerance for lost time accidents and near miss incidents.

Malcolm can provide a safe and cost-effective pile installation alternate for this project.

Respectfully submitted,
MALCOLM DRILLING CO., INC.

A handwritten signature in black ink that reads "Peter Faust". The signature is written in a cursive, slightly stylized font.

Peter Faust
VP Business Development



MALCOLM

Deep Foundations

Cased Drilled Shafts
Uncased Drilled Shafts
Omega Piles
CFA Piles
Micropiles/Tiedowns



www.malcolmdrilling.com

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Deep Foundations

Malcolm Drilling Company combines the most modern and specialized equipment fleet with the construction and engineering experience for all types of Deep Foundations. Our Design-Build expertise allows us to offer the most cost-effective solution for virtually every project need in virtually any type of ground condition.

SELECTION OF DEEP FOUNDATION

Deep Foundations are required when structural loads cannot be supported in shallow soil layers and have to be transferred into a deeper soil strata well below existing grade, and often into bedrock. Structural support elements can have a wide range of variation ranging from 4 to 12 inches in diameter for Micropiles, 16 to 48 inches for CFA and 16 to 24 inches for Displacement piles, while Drilled Shafts can range in diameter from 2 feet to exceptionally large shafts of 12 feet or more. Large diameter Drilled Shafts can reach depths in excess of 250 feet and can support vertical loads of up to 20,000 tons when socketed into competent rock.

Drilled Shafts are designed to withstand a wide range of loading conditions, from compression, tension, lateral and dynamic loads. Drilled Shafts are well suited to cope with a variety of ground conditions ranging from very loose cohesive or soft non-cohesive soils, to hard rock. Expandable clays as well as caving sands, gravels, cobbles and large boulders can be drilled utilizing the state of the art high torque and crowd pressure drilling rigs. Malcolm's expansive fleet of modern equipment utilizing the most advanced drilling techniques ensures that projects can be constructed in highly variable ground.

MALCOLM DRILLING COMPANY

John Malcolm is in the forefront of developing new equipment and techniques to enable his company to become one of the preeminent Geotechnical Construction and Deep Foundations Contractors in North America. Founded in 1962 as a family business, Malcolm Drilling Company, Inc. has expanded as an innovator and leader in the Deep Foundation Industry.

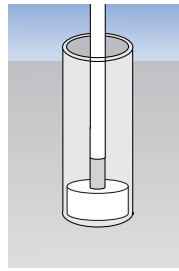
Our experience facilitates a Design-Build approach to projects and allows for timely collaboration with owners, engineers and contractors. This delivery system optimizes cost savings while often offering inherent scheduling advantages and reduced risk to both the owner and contractor. Malcolm's program of capital reinvestment positions our equipment fleet at the forefront of the industry, which allows for early adoption of the most advanced means and methods of geotechnical construction. This is due largely to the fact that Malcolm Drilling is still an independently owned company.

The synthesis of innovation and a productive, professional, safe workforce plus capital equipment reinvestment, enables Malcolm to expand our core services and fulfill our client's needs on a broad geographic basis.



Large Drilled Shaft,
Miami, FL

Cased Drilled Shafts



High load transfer in unstable soil conditions.



Oscillator Shaft, Doyle Drive, San Francisco, CA

Cased Drilled Shafts are required when ground conditions are so unstable that drilled holes cannot safely be stabilized with drilling slurry or where loss of ground must be controlled. Casing can be temporary or permanent steel pipe which provides a 100% stable excavation for the full length of the drilled shaft. Casings can be installed by high capacity impact or vibratory hammers when noise and vibration are of no concern environmentally or to surrounding structures. In all other cases the use of oscillator or rotator machines are the only remaining option.

In 1990 Malcolm introduced the vibration-free Oscillator/Rotator method of installing large diameter Cased Drilled Shafts to North America.

This technology is the only proven method to drill large diameter shafts in caving conditions, such as loose sands and gravelly soil with cobbles and boulders. Boulders several feet in diameter can be removed safely by the use of specialty grab tools without major interruption to the excavation process. Since only water is used for drilling, environmental concerns are minimized or totally eliminated using this technique.

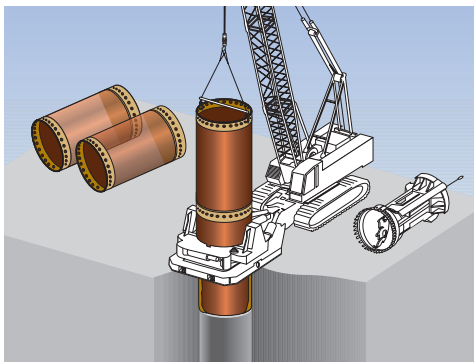
The Oscillator/Rotator method provides a superior method for drilled shaft construction with high quality ensuring an uninterrupted construction schedule through the elimination of anomalies.

The largest fleet of Oscillator and Rotator machines on the North American foundation market.

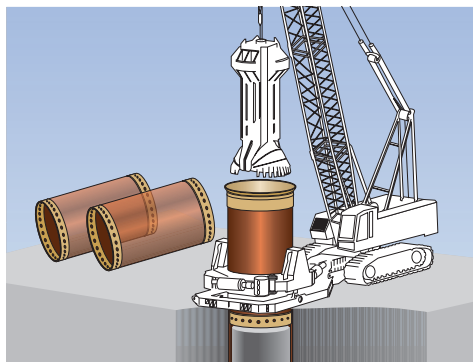
This technology incorporates high torque drill rigs and/or casing Oscillators & Rotators to advance heavy wall steel casing into the ground concurrent with the excavation without any vibration or ground loss. Either permanent steel casings or sectional temporary (removable) casings can be installed over a specified depth or the full length of the drilled shaft. Temporary drill casings are installed in segments of typically 10 to 25 feet and joined with a double wall bolted connector, providing a flush outside diameter of the casing. Carbon teeth on the casing tip allow for greater installation depth and enable the advancement through obstructions as well as penetration into rock.

The soil is removed from inside the casing with a spherical grab, auger or drilling bucket, without disturbing or loosening the surrounding ground.

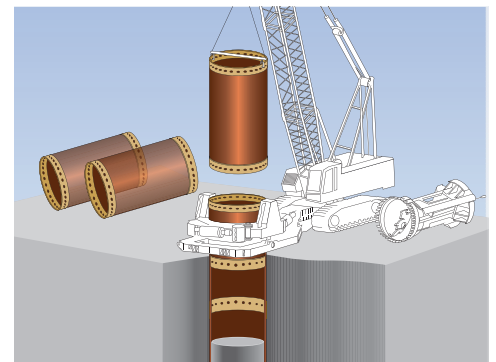
ROTATOR OSCILLATOR TECHNOLOGY



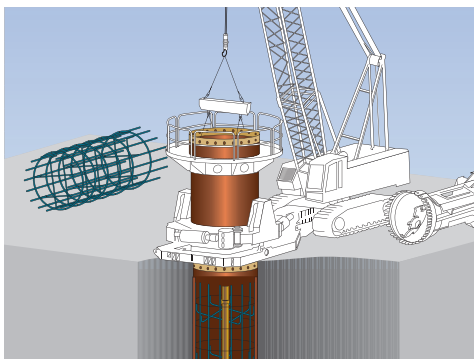
Install starter casing equipped with cutting teeth. Add new casing section with bolted connection.



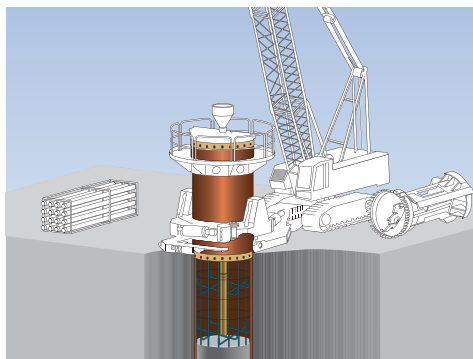
Excavate soil continuously during casing installation. Maintain water head inside casing to balance external hydrostatic head at all times.



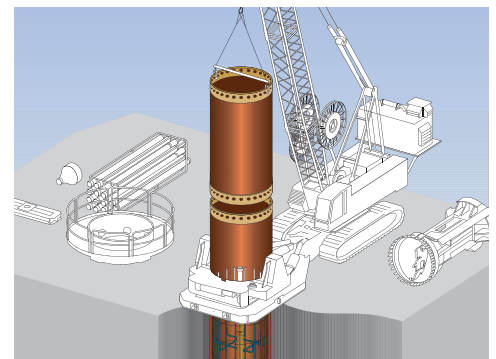
Add new casing sections until pile has been excavated to depth. Keep casing tip ahead of excavation at all times.



Install reinforcement cage and suspend at proper elevation.

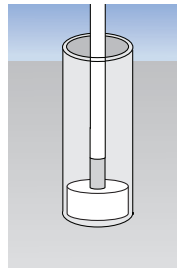


Pour concrete using sectional tremie pipe. Maintain concrete head above casing tip at all times.



Remove casing and tremie pipe sections simultaneously as concrete is poured.

Cased Drilled Shafts



High load transfer in unstable soil conditions.



The temporary casing is removed while always maintaining the concrete tremie pipe within the casing and thus creating a positive concrete head of approximately 8 to 10 feet inside the casing. The specific casing teeth pattern and the oscillating motion during the extraction of the casing will eliminate the potential for a smooth wall surface by creating a grooved pattern during casing removal. The fully cased shaft hence results in a greater soil-to-concrete shear resistance compared with all the other installation methods. Using temporary casing in combination with self-consolidated concrete will enhance overall shaft quality and reduces the risk of shaft non-conformities while providing a more cost effective option than using permanent steel casings.

Malcolm has constructed over 200 projects with shaft sizes from 2 feet to 12 feet in diameter using sectional casing.

In combination with specialized rock drilling tools like Down-Hole-Hammers (DHH) or Air Core Barrels, the powerful rotary drill rigs of MDCI's nationwide

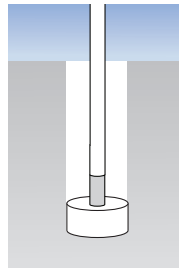


equipment fleet can be used to tackle very difficult overburden soils as well as the hardest rock. On shore as well as off shore applications of this technique have been successfully executed by MDCI in North and Central America.

OPPOSITE: Doyle Drive, San Francisco, CA **ABOVE:** Barge Drilling, Rocky Reach Dam, WA **BELOW:** Yakima River Bridge, WA



Uncased Drilled Shafts



Efficient and flexible foundation element for stable ground condition.



Drilled Shafts (also known as bored piles or caissons) have been used as deep foundations load bearing elements for over 100 years. They have been developed for the transfer of high loads and as a vibration-free alternative to driven piles, which require large pile cap foundations and have certain installation limitations in difficult ground conditions.

Uncased Drilled Shafts are one option of choice when the soil is stable enough to support itself or caving of the borehole can be prevented with the use of a water head or drilling slurry (Bentonite or Polymer). Shaft diameters typically range from 24 inches to 96 inches with extreme sizes of 144 inches or more which are only possible in very stable ground conditions. Standard shaft lengths vary from 20 feet, if bearing layers are relatively shallow, to common depth of 60-80 feet. Extreme depths of more than 250 feet are only possible with specialized drilling equipment.

MALCOLM DRILLING HAS BEEN MANUFACTURING ITS OWN DRILLING TOOLS SINCE 1962, WHILE IMPORTING EQUIPMENT AND METHODS FROM ASIA AND EUROPE SINCE 1982.

Malcolm's extensive equipment fleet includes a multitude of restricted access rigs for difficult site access, machines with long and/or high reach capabilities, and importantly rigs for very deep and hard drilling conditions. Our modern equipment fleet includes specialized low headroom drill rigs, very adaptable LoDrill machines, and the most powerful European hydraulic drilling rigs. Malcolm continues to maintain its tooling and equipment in order to facilitate capital investment back into the company in the form of state of practice equipment, tooling and other cutting edge technologies.



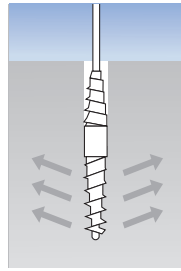
OPPOSITE: 12ft Uncased Shaft, Miami, FL

LEFT: 8ft Uncased Shaft, Fremont, CA

TOP RIGHT: 4ft Uncased Shaft, Las Vegas, NV

BOTTOM RIGHT: 7ft Cluster Drill, San Diego, CA

Omega Piles



Medium high
load transfer
in soft or
contaminated
soils.



OMEGA piles are a full displacement cast In-situ pile system developed in Belgium in 1998. The unique drilling tool allows the lateral displacement of the soil during pile installation. This method increases the lateral stresses in the surrounding soil, enhancing side resistance and increasing the overall pile capacity.

Noise and vibration-free installation.

In combination with the low noise and vibration free installation advantage of the CFA piles, the OMEGA system offers a foundation system with higher load bearing capacity without the need for spoil removal. Such capability is essential for any project site with contaminated soils where spoil handling and removal would otherwise be costly and potentially hazardous.

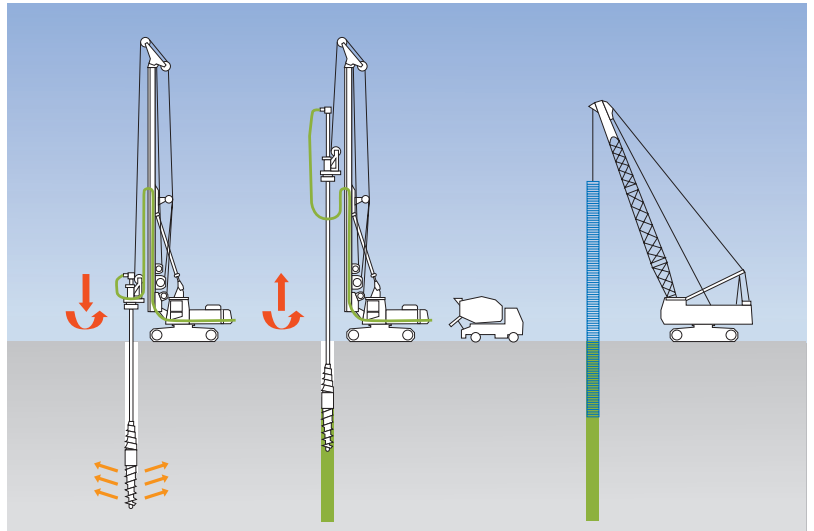
Malcolm is the exclusive Western United States licensee of the patented OMEGA pile system. Since 1998 OMEGA piles have been used to successfully install several hundred thousand piles throughout Europe and North America. MDCI is equipped to install 16 to 24 inch diameter piles to a maximum depth of 96 feet with our modern European fleet of high torque

rotary drilling rigs. Our automatic monitoring system has been successfully used to install projects with a pile-by-pile design resulting in significant cost savings for the owner, due to reduced pile length and a reduction in waste from pile cut offs. Static pile load tests are commonly performed for each project to calibrate design assumptions based on SPT or (preferable) CPT values with actual pile performance data. Compression loads up to 700 tons are possible and lateral as well as seismic loads can be transferred with embedded reinforcement elements.

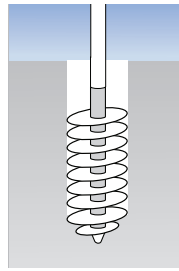
Pile-by-Pile design enables fast and cost effective foundation systems.

The fast and clean (little or no spoils are generated) installation procedure make the OMEGA pile system a very competitive alternative to conventional driven piles for commercial buildings and other structures requiring support for medium loads and where contaminated spoils would be costly to handle.

OPPOSITE: Bauer BG28, Hayward, CA LEFT: 24 inch OMEGA Tool
BELOW: OMEGA Piles, Santa Clara, CA



CFA Piles



Cost effective
pile system in
soft to dense soils.



CFA piles are also commonly called Augercast, Augered Cast In Place Piles (ACIP) or Auger Pressure Grouted Piles (APG). They are predominantly used in unstable soil conditions with a high ground water level when conventional drilling would require casing or drilling slurry to stabilize the bore hole.

CFA pile installation rates are unmatched by any other drilled pile system.

CFA piles can be installed very efficiently with modern high-torque hydraulic drilling rigs up to a depth of 115 feet and 48 inches in diameter. Crane mounted lead systems extend the installation range beyond 150 feet, however, pile diameters are reduced with depth. The method utilizes one continuous auger which is drilled into the ground. The soil on the auger prevents the surrounding ground from caving during the drilling and grouting process. Close control of auger advancement and soil removal is essential to prevent loosening of the soil by excessive removal during the advancement of the CFA auger. After reaching pile tip, the auger is extracted while fluid concrete or grout is pumped through the hollow stem auger to fill the hole under positive pressure. Rebar is installed into the completed

HIGH TORQUE DRILLING EQUIPMENT IS ESSENTIAL FOR COST-EFFECTIVE PILE INSTALLATION.

pile after the auger is removed. CFA installation are highly productive and vibration free.

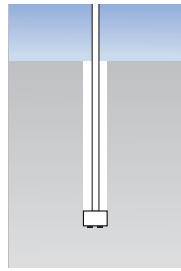
Pile capacities of up to 1,500 tons can be achieved depending on the soil strata. High productivity makes CFA piles most suitable for larger projects. MDCI has the capability to install CFA piles from 16 to 48 inches in diameter to depths in excess of 150 feet.

All of our drilling units are equipped with a state-of-the-art automated monitoring system (B-Tronics) which controls and records in real time multiple drilling parameters, such as advancement rate, grout volume, drill depth, rotation of the auger and drilling resistance rates. During the auger withdrawal a continuous record is produced including grout or concrete injection rates to verify compliance with all quality control requirements.

OPPOSITE: 42 inch CFA, Miami, FL
BELOW: 24 inch CFA, Bakersfield, CA



Micropiles/Tiedowns



Pile system for limited access and retrofitting applications.



Micropiles are small diameter (usually less than 12 inch diameter) drilled and grouted foundation elements with design loads ranging from 50 to 400 tons. The structural load is principally carried in steel reinforcement and transferred by friction into surrounding ground. Micropiles support both tension and compression loading and are cast into pile caps for load transfer to above grade structure. The piles typically comprise a heavy reinforcing bar (up to 3.5 inch diameter) grouted in place with steel casing extending from pile cap to top of load bearing soils.

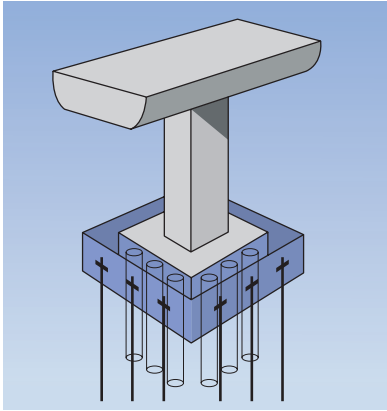
Flexible application due to a variety of drilling methods and specialized equipment.

Specialized drill rigs allow construction in limited access conditions. The equipment can pass through building doorways and operate in headroom of 9 feet, making Micropiles ideally suited to structural upgrades, seismic retrofit and underpinning of existing structures. Our design-build expertise allows us to provide owners with the most efficient foundation solution for every project in the most difficult ground conditions. Tiedown anchors are small diameter friction elements

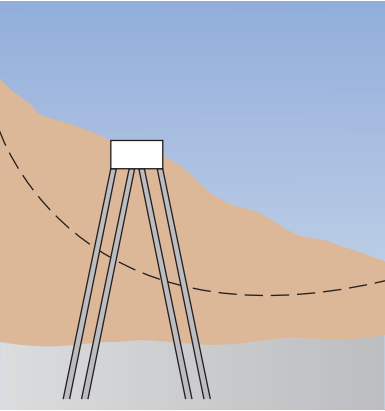
designed and constructed for only tensile loading. Structural capacity is provided by either reinforcing bar or high-strength strands, which are grouted for load transfer to load bearing formations. Tiedowns are typically pre-loaded against structures and locked off to maintain resistance against uplift loads.

Micropiles and Tiedowns are constructed using similar equipment. Rotary hydraulic drills advance the bored hole using sectional lengths of drill steel. Flush thread jointed steel casing can be advanced simultaneously as needed to maintain the hole stability. The core reinforcing is placed into the drilled hole and tremie grouted. The casing is typically withdrawn to top of bond zone for Micropiles, and completed extracted for Tiedown applications. This construction method permits installation in almost any ground conditions, including cohesive and caving granular soils below groundwater as well as rock. Downhole percussion hammers are used for drilling through high strength formations. Micropiles and Tiedowns can provide a cost effective alternate to hand mined underpinning, conventional drilled piers or augercast piling methods in challenging geotechnical conditions.

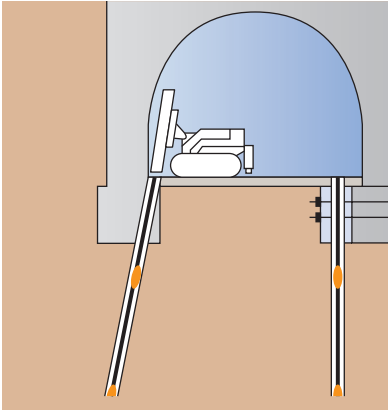
SEISMIC RETROFIT



SLOPE STABILIZATION



LOW HEADROOM



OPPOSITE: Restricted Access Drill Rig
LEFT: Tiedowns, San Francisco, CA
BELOW: Low Headroom Drilling





MALCOLM

Look to the Blue



Front cover: Oscillator Installation, San Francisco, CA
Back cover: Rotator Installation, San Francisco, CA

Malcolm Drilling Company was founded in 1962 in San Francisco, California, which remains our headquarters today. Malcolm operates throughout United States, maintaining a network of regional offices to serve our clients across the country. To learn more about our expertise and for a complete list of locations, visit:

www.malcolmdrilling.com

